(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 410 075 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
18.04.2012 Bulletin 2012/16

(43) Date of publication A2:
25.01.2012 Bulletin 2012/04

(21) Application number: **11171271.7**

(22) Date of filing: **24.06.2011**

(51) Int Cl.:
C23C 14/34 *(2006.01)* ***C23C 14/54*** *(2006.01)*
H01J 37/32 *(2006.01)* ***H01J 37/34*** *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **30.06.2010 US 827053**

(71) Applicant: **PrimeStar Solar, Inc**
Arvada, CO 80004 (US)

(72) Inventor: **Halloran, Sean Timothy**
Arvada, CO Colorado 80004 (US)

(74) Representative: **Bedford, Grant Richard**
Global Patent Operation - Europe
GE International Inc.
15 John Adam Street
London WC2N 6LU (GB)

(54) Methods and apparatus of arc prevention during RF sputtering of a thin film on a substrate

(57) Methods of arc prevention during sputtering of a thin film from a semiconducting target 104 onto a substrate 12 are provided. An alternating current (e.g., having a frequency of about 500 kHz to 15 MHz) can be applied from an electrical power supply 102 to the semiconducting target 104 to form a plasma field 110 between the substrate 12 and the semiconducting target 104. This alternating current can be temporarily interrupted for a time sufficient to sustain the plasma field 110 between the substrate 12 and the semiconducting target 104 to inhibit arc formation during sputtering. Sputtering systems are also generally provided for arc prevention during sputtering of a thin film from a semiconducting target 104 onto a substrate 12.

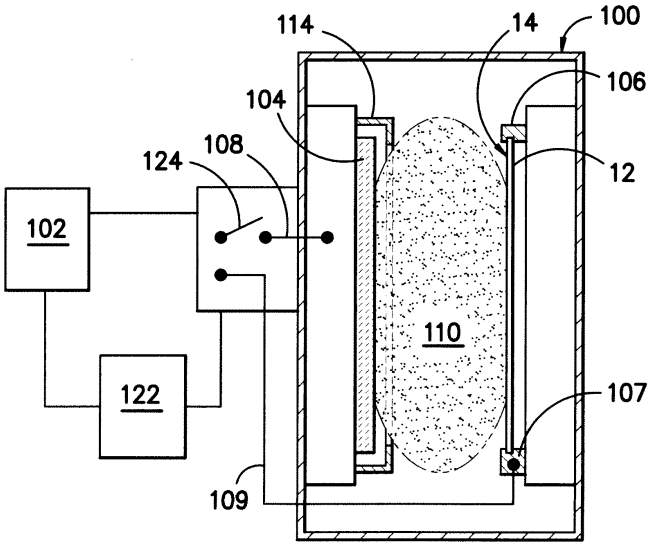

FIG. –5–

EP 2 410 075 A3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 17 1271

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2002/104753 A1 (KLOEPPEL ANDREAS [DE] ET AL) 8 August 2002 (2002-08-08) * page 1, paragraphs 6-8,13-16 * * page 2, paragraph 32-37 * -----	1,2,10, 11,13	INV. C23C14/34 C23C14/54 H01J37/32 H01J37/34
X	WO 2006/116445 A2 (ADVANCED ENERGY IND INC [US]) 2 November 2006 (2006-11-02) * page 2, lines 3-29 * * page 3, lines 1-19 * * page 6, line 1 - page 7, line 2 * * page 8, lines 3-14 * -----	1,2,10, 11,13	
X	EP 1 441 576 A1 (SHIBAURA MECHATRONICS CORP [JP]) 28 July 2004 (2004-07-28) * column 5, paragraph 28-33 * -----	1,2,10, 11,13	
X	WO 2009/118920 A1 (KYOSAN ELECTRIC MFG [JP]; YUZURIHARA ITSUO [JP]; TAKAYANAGI ATSUSHI [J) 1 October 2009 (2009-10-01) * the whole document *	1,2,10, 11,13	
X,P	& US 2010/187998 A1 (YUZURIHARA ITSUO [JP] ET AL) 29 July 2010 (2010-07-29) * page 2, paragraph 23 - paragraph 27; figures 1,3a-3e,4a-4e * * page 3, paragraph 32 * * page 6, paragraph 105 * * page 6, paragraph 114 - page 7, paragraph 121 * * page 14, paragraph 230 * -----	1,2,13, 14	TECHNICAL FIELDS SEARCHED (IPC) C23C H01J
A	US 2006/252283 A1 (TAKEDA TOMOHIKO [JP] ET AL) 9 November 2006 (2006-11-09) * page 5, paragraph 72 - page 6, paragraph 80 * -----	1,13	

-/--

1 ~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	6 December 2011	Joffreau, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 17 1271

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 0 639 655 A1 (ASAHI GLASS CO LTD [JP]) 22 February 1995 (1995-02-22) * page 3, paragraph 20-58 * * page 5, lines 6-11 * * page 5, line 47 - page 6, line 16 * -----	1,13	
			TECHNICAL FIELDS SEARCHED (IPC)

1 ~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	6 December 2011	Joffreau, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 11 17 1271

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-11, 13-15

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

Europäisches Patentamt
European Patent Office
Office européen des brevets

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 11 17 1271

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-11, 13-15

   Method and device for arc prevention during sputtering of a thin film from a semiconducting target

   ---

2. claim: 12

   Method for manufacturing a cadmium telluride based thin film photovoltaic device

   ---

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 17 1271

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-12-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002104753 A1	08-08-2002	AT 353164 T	15-02-2007
		DE 19949394 A1	19-04-2001
		EP 1221175 A1	10-07-2002
		JP 2003511846 A	25-03-2003
		TW 486719 B	11-05-2002
		US 2002104753 A1	08-08-2002
		WO 0127970 A1	19-04-2001
WO 2006116445 A2	02-11-2006	CN 101203858 A	18-06-2008
		DE 06758605 T1	05-06-2008
		EP 1872295 A2	02-01-2008
		JP 2008538852 A	06-11-2008
		KR 20080013873 A	13-02-2008
		US 2006241879 A1	26-10-2006
		US 2008156632 A1	03-07-2008
		WO 2006116445 A2	02-11-2006
EP 1441576 A1	28-07-2004	CN 1565148 A	12-01-2005
		EP 1441576 A1	28-07-2004
		EP 2194566 A1	09-06-2010
		JP 4500048 B2	14-07-2010
		TW 573392 B	21-01-2004
		US 2004177923 A1	16-09-2004
		US 2008036392 A1	14-02-2008
		WO 03037047 A1	01-05-2003
WO 2009118920 A1	01-10-2009	CN 101772992 A	07-07-2010
		EP 2259662 A1	08-12-2010
		KR 20100019573 A	18-02-2010
		TW 200942089 A	01-10-2009
		US 2010187998 A1	29-07-2010
		WO 2009118920 A1	01-10-2009
US 2006252283 A1	09-11-2006	JP 4367953 B2	18-11-2009
		KR 20060039851 A	09-05-2006
		US 2006252283 A1	09-11-2006
		US 2008075640 A1	27-03-2008
		WO 2005015964 A1	17-02-2005
EP 0639655 A1	22-02-1995	CA 2128981 A1	29-01-1995
		DE 69426003 D1	02-11-2000
		DE 69426003 T2	17-05-2001
		EP 0639655 A1	22-02-1995
		SG 46607 A1	20-02-1998
		SG 74667 A1	22-08-2000
		US 5660700 A	26-08-1997

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 17 1271

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-12-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
----------			

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82